A. Soviet Strategic Policies - An initial study of Soviet military objectives, war-fighting scenarios, targeting strategies, and force applications provided the basis for many of the development procedures and policies of NAPB-90.

The study examined stated Soviet views on how they envisioned a nuclear war against the U.S. would be fought. Observations relevant to the development of NAPB-90 were adopted to the extent possible.

1. Soviet Nuclear War-Fighting Objectives - Almost all official pronouncements on this subject (culled from Soviet media) indicate that their main objective in a nuclear war is to attain "victory" over the enemy. Victory, by Soviet definition, is the destruction of the enemy government that started the war, and the disarming and neutralization of the enemy's military forces. Such a war is usually described as "imperialistic" forces facing "socialism" or "socialist coalitions."

In the development of the NAPB-90 target base, close attention was paid to frequent Soviet references to limiting damage to non-target resources of the enemy. This damage-limiting element of the Soviet nuclear war-fighting objectives significantly influenced the procedures used in making final NAPB-90 target aim point selections.

2. Soviet Nuclear War-Fighting Scenarios - Another important influence in the NAPB-90 development was how the Soviets perceived nuclear war would begin and how each scenario would effect their selection of potential targets. The Soviets see three possible scenarios as most likely to start a nuclear war:

- Preemptive attack on strategic warning of enemy attack;
- Launch on tactical warning; and
- Attack in retaliation for being attacked.

Under all of these scenarios, Soviet targeting objectives remained the same. The final NAPB-90 was, therefore, designed to reflect these objectives and is not a prediction of the results of any war-fighting scenario envisioned by the Soviets or by U.S. planners. The decision to make the NAPB-90 planning base scenario-independent is reinforced by the fact that Soviet targeting priorities, as with their objectives, "remain essentially the same" regardless of the a priori scenario under which weapons would be employed.

It was also significant to note that should the Soviets be faced with their scenario which calls for a retaliatory strike after being attacked, they do not see such a strike as "...designed simply to inflict an unacceptable level of damage, the threat of which should have deterred the enemy in the first place."

As to how long a nuclear conflict would last, the Soviets believe that a war "...is more likely to begin with a crisis period in which both sides would ready their forces and take measures to protect their economics (sic) and population." Also, most Soviet authorities see a conventional war phase preceding a nuclear war, with escalation into the use of nuclear weapons as "inevitable."

These Soviet perceptions on the conditions under which nuclear war would start were important factors in determining NAPB-90 planning policies and assumptions to mitigate the nuclear effects risk environments that might result.

3. Soviet Targeting Strategies - Publications carrying speeches and articles by top Soviet military and political leaders make clear that the targets of the Soviet "Strategic Nuclear Forces" reflect their objectives discussed above. Specific NAPB-90 target selection (discussed at length elsewhere in this paper) is based on these Soviet target selections. An important point in their selections is that population, as such, is not specified as a Soviet target.

4. Soviet Force Application - The Soviet application of their nuclear targeting strategy follows these force-application principles, most of which influenced the development of the NAPB-90 target base:

- Destroy "most threatening" enemy forces;
- Select "main links and nodes" in target "sets" (such as the National Command Authority);
- "Do not destroy large areas or create radioactive deserts;"
- Use minimum weapon yields ("explosive power") necessary so as not to drastically "overkill" the target;
- "Prepare to strike most important targets twice;" and
- "It is not possible, nor desirable, nor necessary to attack and destroy all targets (in the operational zone)."

These force-application principles (among many more) agree with Soviet doctrines and strategies discussed above. The "enemy" is to be defeated through destruction of its military forces and by preventing their reconstitution.

B. NAPB-90 Target Selection Considerations - Ten target classes containing 6,139 aim points were included in an initial target set as follows:

Target Class	Aim Points
° ICBM silos and launch control centers	1,228
° Other Air Force facilities and complexes	199
° Other Army facilities and complexes	159
° Other Navy facilities and complexes	110
Total other military facilities and complexes	(468)
° Key military-support industries	325
° Political infrastructure	44
° Ports and port facilities	106
° Petroleum refineries	242
° Electric power generating facilities	1,632
° Chemical industry facilities	2,094
Total Initial Aim Points	6,139

The initial target set served as a basis for aim point editing to meet Soviet strategic objectives.

1. Military Aim Point Editing - In the ICBM silos and launch control center class, all aim points included in the Titan missile complexes at Little Rock Air Force Base (AFB), Little Rock, Arkansas; McConnell AFB, Wichita, Kansas; and Davis Monthan AFB, Tucson, Arizona, were eliminated. All of these missile complexes are being or will be phased out within the 1985-1990 period and will, therefore, cease to be potential targets.

2. Editing of Industrial Aim Points - Over 60 percent of the original aim points listed above occurred in three target classes: petroleum refineries, electric power generating facilities, and chemical industry facilities. This large number made it obvious that these classes would require extensive editing since they covered the majority of industrial facilities in each class, a large number of which were small industries not considered significant enough to be included for national damage assessment purposes.

a. Editing of Petroleum Refineries Class - For the editing of the petroleum refineries class, no refinery with a capacity of less than 75,000 barrels per day was considered a potential target. The remaining industries in the class were targeted. It was assumed that a rank order degradation of refinery capacities to an assured level of 75 percent damage or destruction would constitute effective neutralization of the industry without its total destruction.

b. Editing of Electric Power Generating Facilities Class - For the editing of the electric power generating facilities class, facilities were ranked ordered by generating capacity. These site capacities were then selectively targeted until an assured 75 percent degradation was achieved. This level of degradation was assumed to effectively neutralize the capability of

the electric power grid network to transmit or exchange generated power, and also did not totally destroy the industry as a whole.

c. Editing of Chemical Industry Class - The basis for editing the chemical industry class was a Stanford Research Institute study done for the Office of Civil Defense in 1968. This study was an assessment of the severity of damage to the chemical industry as a result of nuclear war. It indicated that the worst-case scenario for the chemical industry as a whole would be the damage or destruction of those chemical facilities furnishing "basic" chemicals--chemicals necessary or common to a chemical industry itself as well as to other industries. These basic chemical industries include those which manufacture alkalines and chlorines, industrial gases, inorganic and organic chemicals, and pigments (grouped under the Standard Industrial Code 281 category). Aim points for this category were selected and targeted to provide an assured neutralization of all other chemical industries. These aim points replaced the initial chemical class listing.

C. NAPB-90 Weapon Inventory File - The Soviet strategic weapon arsenal used as the initial NAPB-90 weapon inventory file was developed from a Soviet inventory published in a report by the Congressional Budget Office (CBO) titled "Counterforce Issues for U.S. Nuclear Forces," January 1978. The report projected Soviet strategic forces through 1985. Since NAPB-90 is intended to reflect a threat planning base through 1990, the CBO data were selectively modified to reflect probable changes in currently deployed Soviet strategic forces through 1990. Table C-1 shows the initial CBO data together with the predicted changes. Notes on these and other changes reflect 1990 Soviet strategic weapon deployments reflected in a Department of Defense report, "Soviet Military Power," fourth edition, April 1985.

Table C-1. Established Soviet Military Forces, 1985

Launch Vehicle	Number in Inventory	Warheads Each	Warheads Total
INTERCONTINENTAL BALLISTIC MISSILES			
SS-11 [1]	420	1	420
SS-13 [2]	60	1	60
SS-17 [3]	150	4	600
SS-18 [4]	308	10	3030
SS-19 [5]	360	6	2160
TOTAL ICBM	1298		6300
SUBMARINE-LAUNCHED BALLISTIC MISSILES			
SS-N-6/8 [6]	600	1	600
SS-N-17/18 [7]	300	3	900
TOTAL SLBM	900		1500

Notes on projected 1990 force posture are found on next page.

1/ Mods #2 and #3 are principally deployed; 420 launch vehicles total.
2/ No change from 1985 deployment posture.
3/ Mod #3 deployed; 150 launch vehicles total.
4/ Mod #4 deployed; 308 launch vehicles total with 10 warheads each.
5/ Mod #3 deployed; 360 launch vehicles.
6/ For the SS-N-6, Mods #2 and #3 deployed; Mod #3 will have 2 warheads each. For the SS-N-8, Mod #2 deployed.
7/ The SS-N-17 had limited deployment. For SS-N-18, Mod #3 deployment is assumed; will have 7 warheads each.

New Vehicles: ICBMs: SS-X-24 and SS-25 have limited deployment.
SLBMs: SS-N-20 deployed; 6 to 9 warheads each. SS-NX-23 to be deployed on Delta IV class submarines.

Although standard weapon employment procedures were followed, closer attention was paid to the assumed weapon yields which could influence the extent and degree of potential risk, as well as the probability of that risk occurring in a given area than to the weapon delivery system employed.

While all actions were taken to ensure a realistic representation of Soviet strategic nuclear force applications, it should be emphasized that NAPB-90 does not attempt to predict the specific weapons applications of Soviet strategic planners. The structure of the final Soviet weapon systems used has, therefore, little relevance to the planning purpose of the base, i.e., to depict potential nuclear weapons effects.

D. Targeting Considerations - It was pointed out earlier that one of the principal differences between the TR-82 planning base and NAPB-90 lay in the manner in which weapons were employed against potential targets. NAPB-90 aim points were attacked using estimates of Soviet strategic targeting procedures, i.e., Soviet views on nuclear weapons effects and target vulnerabilities. The following discusses targeting considerations employed by NAPB-90:

1. Height of Weapon Detonation - A nuclear weapon generates very large blast overpressures. The range or extent of this blast overpressure is closely related to the height of burst (HOB) of the weapon. Nominally, this is referred to as an "optimum HOB" since it represents the height chosen by the strategic planner to maximize desired levels of overpressures over the widest possible area. A particular overpressure level is chosen to assure the desired damage or destruction of the target.

The optimum HOB selected for NAPB-90 "soft" or area targets (such as a large industrial facility) normally precludes the weapon's fireball from reaching the ground. In these cases, the weapon can be said to be "air-burst."

When the fireball in whole or in part touches the ground, the weapon is considered "surface-burst." NAPB-90 employed surface burst weapons against "hard" or point targets (such as missile silos).

In both cases, NAPB-90 weapons were employed at an altitude which assured generation of the overpressure believed necessary to damage or destroy the potential target.

2. Target Surface Characteristics - NAPB-90 weapon employment considered the influences on the extent of overpressure generated by weapon detonations--ranges significantly influenced by the surface characteristics of the target. These characteristics have a marked effect on the range of overpressures, each surface characteristic having its own optimum HOB to maximize particular psi overpressures. The reasons for these differences are discussed below.

- Ideal surfaces are perfectly flat terrain and reflect all of the overpressure (or "mechanical") and thermal (or "heat") energies of the weapon, i.e., nothing inhibits the spread or range of these effects. Ideal surfaces are used as a hypothetical "base case" for weapon characteristics. No such surfaces exist on earth.

- Near-ideal surfaces are "reasonably" flat terrains and reflect most of the mechanical and thermal energy of the weapon. Ice, hard-packed snow, water, and frozen tundra are examples of this type of surface. Inhibitions of generated energies on this type of surface are small.

- Non-ideal surfaces are flat to uneven terrains which can interact with the thermal energy of the weapon through ignition of surface material and the generation of large amounts of dust and debris. The dust and debris absorb some of the thermal energy and heat the air above normal temperature around the target. Together with the dust, this higher air temperature "pocket" interacts with the reflection of the blast wave off of the surface and a "precursor" or leading pressure wave is formed. The result is that the range of mechanical overpressures is reduced and the dynamic or "punch" pressure is increased.

Weapon effects on near- and non-ideal surfaces can be further influenced by types of soil, the degree and density of vegetation, and the amount of moisture present in the area. All of these additional characteristics inhibit the range of overpressures. Strategic planners refer to such surface characteristics as "grey areas" in calculating optimum HOB's.

3. Target Vulnerability - The choices of weapons employed by NAPB-90 were based upon the weapon HOB necessary to maximize selected overpressures. The overpressure selected was based upon the vulnerability of the target and the desired level of damage or destruction to be achieved. The "soft" targets discussed earlier are generally vulnerable to low levels of overpressure (some industrial plants will sustain substantial damage at as low as 3.0 psi). "Hard" targets require very much higher overpressures to effect damage or destruction.

As a general rule, then, a soft target in the NAPB-90 listing was attacked with an air-burst weapon to achieve the widest possible range of the desired blast overpressure and employment of the weapon did not generally result in

the creation of fallout (see a discussion of this in Part 3.B., "Fallout Risk"). The converse applied to very low or surface-burst weapons which NAPB-90 employed against hard targets.

4. Probability of Damage or Destruction - A strategic planner works to assure that a chosen target will be damaged or destroyed. If all weapon employment considerations are correct and the weapon detonates at the aim point, damage or destruction will (theoretically) be assured. Weapon systems, however, are not 100 percent reliable. To add assurance that the goal will be met, NAPB-90 weapon employment considered two other factors:

- The accuracy of the weapon - NAPB-90 aim points represented the desired point of weapon detonation (nominally, the "desired ground zero" or DGZ). Weapon guidance systems, however, will usually deviate from this DGZ by a predictable distance and probability. The amount of this deviation, measured in feet from the DGZ, represents the radius of a circle around the DGZ within which the weapon can be expected to impact a warhead at least 50 percent of the time. This deviation is called the "circle error probable" or CEP of the weapon. NAPB-90 weapon employed considered CEP's to determine the HOB of the weapon to ensure that desired overpressure ranges would reach the target.

- The probability of arrival of the weapon - This is an expression of the combined probability the launch vehicle will (1) have a successful launch; (2) follow its programmed trajectory or course; and (3) its weapon detonates upon arrival at the target. NAPB-90 considered the probability of arrival of the weapon to determine if multiple weapons were needed to ensure destruction of the target.

E. Other NAPB-90 Considerations

1. "Nuclear Winter" - In 1984, a group of scientists produced a study which hypothesized that a large-scale attack on the U.S., principally against urban areas, would result in an injection into the atmosphere of an inordinate amount of smoke and soot from attack-generated fires. Their study (called "TTAPS" after the initials of the co-authors) predicted that a severe drop in temperature or a "Nuclear Winter" would result from the sun's energy being absorbed by the cover of smoke and soot. The study produced widespread interest within the scientific community, the media, and among the general public.

In the intervening time since its publication, a large number of scientists (including some of the original authors) and scientific organizations (such as the National Academy of Sciences) have acknowledged that there are uncertainties connected with the original hypothesis. Some investigations made since the TTAPS study have suggested that the amount of smoke and soot produced may be much less than that predicted by the study. Weather conditions, such as cloud cover and turbulence due to uneven smoke and soot distributions, may accelerate the "cleansing" of the atmosphere more rapidly

than originally suggested. The hypothesis also depends on a number of broad assumptions of local weather conditions, the distribution pattern of the smoke and soot in the upper atmosphere, the number and location of targets that will be attacked, the amount of available fire fuel in the target area which will ignite and burn, and the like. The current trend in both Soviet and U.S. warheads toward more accurate, low-yield weapons designed to limit collateral damage around a target has also suggested the effects may be less severe than those suggested by the study.

Until these uncertainties are resolved, the concept of a "nuclear winter" as predicted by the TTAPS study does not justify a shift in current civil preparedness planning and policy. Until more research and study are carried on this potential phenomenon, such an hypothesis cannot be incorporated into a civil preparedness planning base.

In the interim, NAPB-90 provides an objective analysis of the known potential nuclear attack effects.

2. Electromagnetic Pulse (EMP) - A secondary but nevertheless important effect of any nuclear detonation appears as an electromagnetic pulse. It is another form of energy released by the weapon in the electromagnetic radiation spectrum. At the high end of this spectrum, the weapon generates initial nuclear radiation (X-rays and gamma rays) at the moment of explosion; thermal radiation energies given off by the explosion are in the infrared and ultraviolet frequencies of the spectrum; and the electromagnetic pulse (composed of electrons) covers the lower end of the spectrum. The frequencies in this part of the spectrum are among those used in electric power generation, many forms of radio and television transmission, and military communications and detection systems.

The EMP effect resulting from a nuclear detonation within the earth's atmosphere is generally not significant, but if high yield weapons are detonated outside of the atmosphere, an efficient conversion of nuclear energy into the eletromagnetic frequency range occurs. This energy can cover a very substantial area and has the capability of "coupling with and affecting the operation of electrical and electronic equipment which has not been protected. Examples of EMP damage observed during the atmospheric test programs ranged from damaged cables due to "arc-overs" to the false tripping of street light systems many hundreds of miles from the detonation point. Similar results have been observed for modern, sophisticated equipment exposed to simulated EMP. Such equipment, if not otherwise protected, has a very high probability of becoming inoperative at even very low levels of EMP. In general, the more modern and sophisticated the equipment, the higher the potential for EMP degradation.

These and other concerns about the potential EMP damage to electric power and communications systems certainly demand the attention of emergency planners. Preparedness measures to mitigate the blast, fire, and fallout risks outlined by NAPB-90, as well as long-term measures to maintain life support, must consider the possibility of additional burdens imposed by EMP before, during, or after a nuclear attack.

The effect of the potential use of nuclear weapons to deliberately create an EMP effect is, however, considered to be a war-fighting option. Since NAPB-90 is scenario-independent and does not purport to predict how a nuclear war would be fought, EMP must be considered outside its scope.

3. Strategic Defense Initiative (SDI) - In 1983, the Administration proposed that a strategic defense be initiated to explore the feasibility of providing a defense against ballistic missiles. Research was begun on technologies which could support a capability to engage and destroy hostile ballistic missiles during four phases of the missiles' flight paths:

- The boost or launch phase while the missile is accelerating;
- The mid-course or post-boost phase when the propulsion rockets of the missile have separated from the warhead;
- The mid-course phase when the warhead goes through the topmost section of its ballistic path; and
- The terminal phase when the warhead is in its final descent toward the target.

In short, SDI research is exploring the feasibility of a multi-layered space defense shield along the entire spectrum of the flight of a ballistic missile. What configuration this multi-layered approach will take if employed, is not now known. Hence, the exact relationship of SDI and the civil preparedness program cannot be determined. A deployed strategic defense probably will not be able to determine--in the boost and mid-course phases--which U.S. targets had been spared by the destruction of a single missile. On the other hand, this relationship could be surmised when terminal phase defenses have been emplaced to protect specific targets. For targets not protected by a terminal defense, potential targets following activation of the strategic defense could not be realistically determined.

For the foreseeable future, then, planning against the potential effects of a nuclear war must be based on current and predicted offensive nuclear forces which could be employed against U.S. targets.

F. References - The following publications were used in the development of NAPB-90. Except where noted, all are available in the public domain:

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